Model 8550/8551

Q-TRAK™ IAQ Monitor

Operation and Service Manual

April 1999
P/N 1980197 Rev. H

TSI Incorporated

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SHIP TO:
TSI Incorporated
500 Cardigan Road
Shoreview, MN 55126-3996
USA

U.S.
Sales & Customer Service:
(800) 926-8378/(651) 490-2760
Fax:
(651) 490-2704

MAIL TO:
TSI Incorporated
P.O. Box 64394
St. Paul, MN 55164-0394
USA
E-mail address:
Health.safety@tsi.com
Web site:
http://www.tsi.com

INTERNATIONAL
Sales & Customer Service:
(001 651) 490-2760
Fax:
(001 651) 490-2704

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Address
TSI Incorporated/P.O. Box 64394/St. Paul, MN 55164/USA

Fax No.
(651) 490-2704

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Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (800) 926-8378 (USA) or (001 651) 490-2760 (International).

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Chapter 1

Unpacking and Parts Identification

Carefully unpack the Q-TRAK IAQ Monitor from the shipping container. Use the tables and illustrations below to make certain that there are no missing components. Contact TSI immediately if anything is missing or damaged.

Packing List for the Model 8550/8551 Q-TRAK IAQ Monitor

Quantity	Item Description	Part/Model
1	Q-TRAK IAQ Monitor	8550/8551
1	Carrying Case	800680
4	AA Alkaline Batteries	1206013
1	AC Adapter 115 V, NEMA-5 230 V, Eur., CEE 7/16 230 V, Great Britain 240 V, Australian	 2613033 2613078 800169 2613105
1	TRAKPRO Data Analysis Software on 3.5 inch diskette*	800700
1	CO_2 Calibration Collar	800678
1	CO Calibration Adapter (Model 8551 only)	800696
1	CO Sensor (Model 8551 only)	800695
1	Probe Stand	800679
1	Computer Interface Cable (RS-232)	800560
1	25-Pin to 9-Pin Serial Cable Adapter	1302690
1	Q-TRAK IAQ Monitor Operation and Service Manual	1980197
1	TRAKPRO Data Analysis Software User's Manual	1980200
1	Certificate of Calibration	-

*The software is provided on 3.5" high-density diskettes. If you require 5.25" 360k diskettes, please contact your local distributor or TSI. Free 5.25" diskettes will be provided promptly.

Parts Identification for the Q-TRAK

Figures 1–1 and 1–2 identify the parts of the Q-TRAK IAQ Monitor. Please become familiar with these components before proceeding.

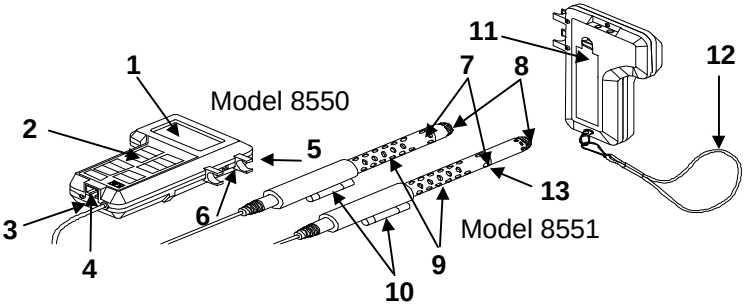


Figure 1–1: Q-TRAK

1. Display
2. Keypad
3. External Power Socket
4. Data Port RS-232
5. Probe Mounting Clips
6. Display/Keypad Lockout Switch
7. Location of Humidity Sensor
8. Location of Temperature Sensor
9. Location of CO_2 Sensor
10. Probe Handle
11. Battery Access Cover
12. Wrist Strap
13. Location of CO Sensor (model 8551 only)

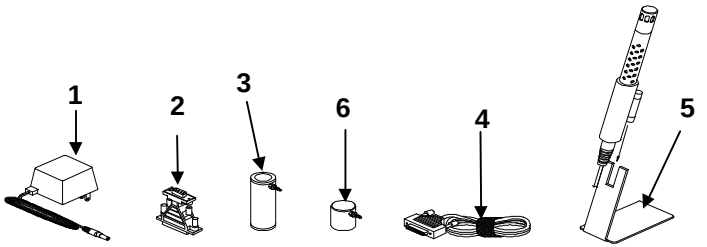


Figure 1–2: Q-TRAK Accessories

1. AC Adapter
2. 25-Pin to 9-Pin Adapter
3. CO_2 Calibration Collar
4. Computer Interface Cable
5. Probe Stand
6. CO Calibration adapter (Model 8551 Only)

Chapter 2

Setting-Up

Supplying Power to the Q-TRAK

The Q-TRAK IAQ Monitor must be powered in one of two ways: four size AA batteries or the supplied AC Adapter.

Installing the Batteries

Insert four size AA batteries as indicated by the diagram located on the inside of the battery compartment. TSI ships the Q-TRAK with alkaline batteries. NiCd rechargeable batteries may also be used.

Using the AC Adapter

The AC Adapter allows you to power the Q-TRAK from an AC wall outlet. When using the AC adapter, the batteries (if installed) will be bypassed. The AC adapter is not a battery charger and will not charge NiCd batteries.

The Q-TRAK has an internal, non-user accessible battery that is used to keep memory intact when power is turned off. Changing the AA-size batteries or disconnecting the AC adapter will not cause data to be lost. This battery is designed to last for years. TSI will install a new battery, if necessary, when the unit is returned to the factory for service.

Instrument Setup

The Q-TRAK comes with special software called TRAKPRO, which is designed to provide you with maximum flexibility and power when using the Q-TRAK. The following sections describe how to install the software and setup the computer.

Setting-up TRAKPRO Data Analysis Software

TRAKPRO software contains a very comprehensive Help Function. This utility provides all the necessary information to guide you in all aspects of software operation.

Connecting the Q-TRAK to a Computer

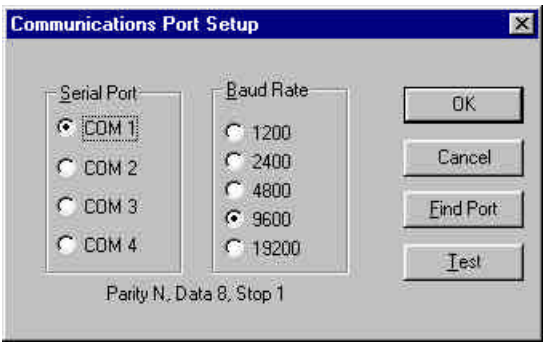
Each Q-TRAK comes equipped with an RS-232 cable and a 25-pin to 9-pin serial cable adapter. One end of the cable is a 25-pin D subminiature connector labeled COMPUTER; the other end is an RJ-45 modular connector that mates with the logging instrument. Serial port connectors always have pins (male) on the computer side.

1. Locate an available serial port on your computer: COM1, COM2, COM3, or COM4.
2. If the port has a 25-pin connector, you do not need the adapter. If the port has a 9-pin connector, plug the 25-pin end of the adapter into the RS-232 cable.
3. Connect the RS-232 cable to the available serial port on your computer.
4. Connect the RJ-45 connector to the Q-TRAK.

Set-Up the Communications Port

To communicate with the Q-TRAK, the software must be configured for the proper COM port. TRAKPRO can be manually set to operate on a specific COM port, or it can automatically find a Q-TRAK that is attached to any COM port. To set up the COM port, do the following:

1. Turn on the Q-TRAK and start TRAKPRO.
2. Select **Communications** from the **Instrument Setup** menu. The following dialog is displayed:



3. Select the following:

Serial Port	Select the name of the serial port to which the logging device is connected: COM1, COM2, COM3, or COM4.
Baud Rate	Select the baud rate for the port. Higher baud rates are recommended to transfer data at a faster rate. Select a lower baud rate only if you are having trouble communicating at a higher rate.

4. Select **Test** to verify that you have set up the communications port properly. The system displays an informative message indicating whether it was able to establish communications.

5. As an alternate, you may select **Find Port**, to have TRAKPRO search the available COM ports, looking for an attached Q-TRAK.

6. Select **OK** to accept the setup or **Cancel** to discard the changes.

***Note**: Some computers do **not** communicate reliably at baud rates above 9600.*

Setting the Real-Time Clock

The Q-TRAK has an internal real-time clock that keeps track of the time of day (the format is HH:MM where HH is the hour in 24-hour format and the MM is minutes) and the date. It is very important for the Q-TRAK to have the time and date correctly set; otherwise, date and time stamping of recorded data and calibrations will not be correct.

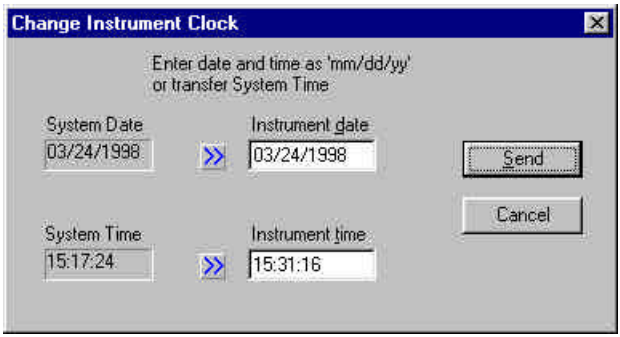
There are two ways to set the time and date. The first is to use the supplied TRAKPRO Data Analysis Software.

Programming the Date/Time Using TrakPro

To program the Q-TRAK date and time:

1. Make sure the Q-TRAK is connected to the computer and turned on.

2. Select **Parameters**, then **Clock** from the **Instrument Setup** menu. TRAKPRO retrieves the current date and time settings from Q-TRAK and displays them in the following dialog:



3. The system date and time (from the computer) may be transferred to the Q-TRAK using the “arrows” keys. Alternately, the date and time may be manually entered into the dialog box.

4. Select **Send** to reprogram the Q-TRAK.

Manually Setting the Real-Time Clock

To set the time and date with the keypad, you must press and hold the SAMPLE key down while the Q-TRAK displays the time of day during its power-up sequence. Release when the Q-TRAK "beeps." You will have an opportunity to view and/or change the hours, minutes, year, month and day of month in sequence. Use the up and down arrow keys (↑↓) to change a setting. Use the SAMPLE key to store each setting and advance to the next one.

Using the Probe Stand

For your convenience, the Q-TRAK is supplied with a probe stand so that the probe can be located above a table surface while unattended. To use it, simply detach the probe from the Q-TRAK mounting clips and slide it onto the stand.

Connecting the Optional Model 8925 Portable Printer

To connect the Model 8925 printer to the Q-TRAK, locate the Printer Interface cable (supplied with optional printer) and connect the 9-pin end labeled "PRINTER" to the printer and the other end to the data port on the Q-TRAK. Always turn the Q-TRAK on BEFORE the printer. If the printer prints question marks (??????), asterisks (******), or random characters, reset it by turning it off and then on again. If necessary, refer to the *Model 8925 Portable Printer Operation and Service Manual*.

Chapter 3

Operation

Overview

The Model 8550 and Model 8551 Q-TRAK IAQ monitors measure CO_2, temperature, and relative humidity. In addition the Model 8551 also measures CO concentration. All parameters are measured simultaneously in a single probe. The Q-TRAK has four modes of operation, Survey, LOG 1, LOG 2, and LOG 3. When the Q-TRAK is first turned on it will be in Survey mode which is used to display real-time readings and to determine statistics such as average, minimum, and maximum readings. LOG 1 mode is used to record individual data points for later analysis using a factory set protocol. LOG 2 and LOG 3 modes have user-defined protocols, set up using TRAKPRO software. TRAKPRO software is used for analysis of data taken in any of the three LOG modes, but cannot be used on samples taken in Survey mode.

Keypad Functions

When pressing the keys on the front panel, the Q-TRAK will beep to confirm the function. If you press a key and the Q-TRAK does *not* beep, the Q-TRAK does not allow that function during the selected sampling mode. To disable the beep, refer to Appendix B: "Internal DIP Switch Settings."

ON/OFF Key

Use the ON/OFF key to turn the Q-TRAK on and off. When the instrument is first turned on it goes through a preprogrammed power-up sequence that includes an internal self-check. First, all displayable items will appear for a few seconds. If a problem is detected, the display shows the message "SERVICE" along with a number to indicate that the Q-TRAK requires servicing. Refer to Chapter 5: "Troubleshooting" for information regarding service numbers. If the "SERVICE" message appears, the Q-TRAK pauses until any key is pressed.

When the Q-TRAK completes its internal self-check, it will display the approximate percentage of battery life remaining. The Q-TRAK displays the battery symbol when the battery voltage becomes very low. After the battery symbol appears, the Q-TRAK runs for approximately 60 minutes before displaying the message "LO" (for a few seconds) and then automatically turning off. This feature is accurate for alkaline batteries only.

The percentage life remaining will *not* be accurate for NiCd batteries. The battery symbol appears when battery voltage becomes low, but the Q-TRAK will run considerably less than 60 minutes before displaying the message "LO" and turning off.

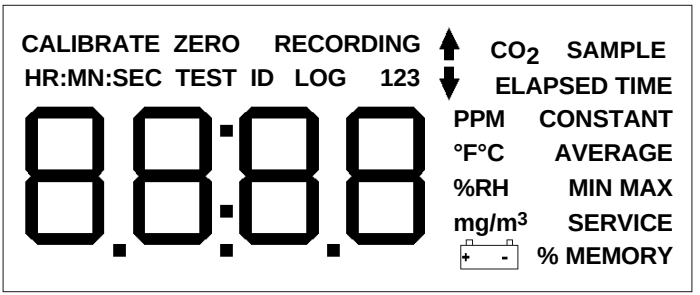


Figure 3–1: Q-TRAK Display With All Elements Shown

After displaying the percentage of battery life remaining, the current time set on the internal real-time clock is displayed. When the self-check is complete, the Q-TRAK will be in Survey mode.

CO_2 Key

Press the CO_2 key to display CO_2 readings. Carbon dioxide concentration readings will be displayed in units of parts per million (ppm). Place the sensor in the location where you want to take the measurement. The probe must be fully exposed because the CO_2 sensor is located between the probe tip and the handle, not at the tip.

Caution
Do *not* hold the probe close to your breathing zone. Humans exhale CO_2 and this will influence the readings.

TEMP Key

Press the TEMP key to display air temperature readings. The temperature sensor is located near the tip of the probe. The Q-TRAK displays temperature readings in either degrees Celsius (°C) or degrees Fahrenheit (°F) depending on the DIP switch settings (refer to Appendix B).

Caution
Do *not* use the Q-TRAK to measure the temperature of liquids. The sensor is *not* designed for submersion.

HUMIDITY Key

Press the HUMIDITY key to display humidity readings. The humidity sensor is located near the tip of the probe. The readings will be in units of percent relative humidity (%rh).

Caution

The humidity sensor is sensitive to the effects of water. Do *not* expose the sensor to liquid water. This will damage the sensor. Also, the humidity sensor will *not* function properly while exposed to intense light, such as direct sunlight. Shade the probe to avoid false readings.

CO Key (Model 8551 Only)

Press the CO key to display CO readings. Carbon monoxide concentration readings are displayed in units of parts per million (ppm). The CO sensor is located at the tip of the probe.

SAMPLE Key

Press the SAMPLE key to start/stop data sampling. The word "SAMPLE" appears in the upper-right corner of the display while the Q-TRAK is taking a sample. When sampling is stopped, the Q-TRAK automatically scrolls through statistics for the sample that just ended.

TIME CONSTANT Key

Momentarily press and release the TIME CONSTANT key to view the current time-constant. To change the time-constant, press and hold the key down. The available time-constant choices will sequence on the display. When the desired value is displayed, immediately release the key.

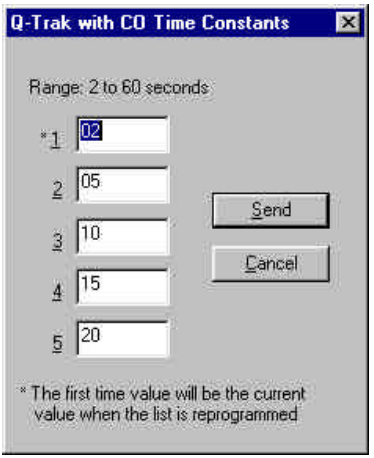
The time-constant is actually an averaging period. The Q-TRAK display is always updated every second; however, the reading displayed is the average reading over the last time-constant period. For example, if the current time-constant is set to 10 seconds, the display shows readings averaged over the previous 10 seconds, updated every second. This is also called a 10-second "moving average."

As configured at the factory, the available time-constant values are 2, 5, 10, 15, and 20 seconds. The internal list of time-constant values can be altered using Q-TRAK Data Analysis Software supplied with the Q-TRAK. The range of time constants allowed is 2–60 seconds. See the following instructions.

Programming the Available Time Constants

To program the list of time constants using Q-TRAK Data Analysis Software:

1. Make sure the Q-TRAK is connected to the computer and turned on.
2. Select **Parameters,** then **Time Constants** from the **Instrument Setup** menu. TRAKPRO retrieves the current time constant settings from the Q-TRAK and displays them in the following dialog:



3. Enter a value for each of the five available time constants. (The range is limited to 2–60 seconds.)
4. Select **Send**.

The Q-TRAK is reprogrammed to offer the time constants you have specified.

STATISTICS Key

Use the STATISTICS key to sequentially view the average, minimum, and maximum readings as well as the elapsed time of the most recently sampled data. You may view sample statistics while the sample is in-progress; however, one time-constant must have elapsed first. If one of the LOG modes is active, a test identification number is displayed also. Press the STATISTICS key once to display the average reading, again to display the minimum reading, again to display the maximum reading, and again to display the elapsed time for that sample (and again for the test ID if in LOG mode). If you press the STATISTICS key a fifth time (sixth time if in LOG mode), the Q-TRAK switches back into the currently selected measuring mode. You must sequence through all four statistic displays (i.e., press the

STATISTICS key five times, six if in LOG mode) before the Q-TRAK goes back into the currently selected measuring mode. All parameters are measured simultaneously. The display shows only the data for the current measurement mode. The measurement mode may be changed at any time to view statistics for the other measurements.

PRINT Key

Use the PRINT key to print information on the optional Model 8925 Portable Printer. The information printed will be different depending on what the Q-TRAK is currently doing.

When the Q-TRAK is displaying real-time readings, pressing the PRINT key will cause all parameters being measured to be printed along with the time and date. Each time the PRINT key is pressed, one set of values prints. The values printed reflect the current time-constant; therefore, they are the same as would be displayed.

When the Q-TRAK is displaying any statistic, pressing the PRINT key will cause the current statistics to print. All statistics are printed as a set regardless of which one is currently displayed.

When the Q-TRAK is in one of the LOG modes and is idle ("%MEMORY" is displayed), pressing the PRINT key will cause the logging setup for the current LOG mode to print.

If you press and hold the PRINT key during the power-up sequence, and you have the optional Model 8925 printer connected, a printout showing certain system information occurs.

SAMPLING MODE Key

The SAMPLING MODE key allows you to select between the four sampling modes: Survey, LOG 1, LOG 2, and LOG 3. Each time you press the SAMPLING MODE key, the Q-TRAK will sequence to the next mode. When the Q-TRAK is in Survey mode, the current measurement is shown on the display. When one of the LOG modes is selected, the LOG mode number, i.e., "LOG 1," "LOG 2," or "LOG 3" is displayed along with the percentage of free memory available.

Survey Mode:

When the Q-TRAK is first turned on, it will always be in Survey mode. Survey mode allows you to make simultaneous measurements of CO_2 concentration, temperature, and relative humidity, and to obtain statistics for each measurement when a sample is taken. The statistics include the average, minimum, and maximum values, as well as the elapsed time for that sample. Individual data points are not recorded

(this can be done in any of the LOG modes). Each new sample taken in Survey mode clears the previous sample data from memory. Data taken in Survey mode remains in memory until another sample is made, or until samples are taken in one of the LOG modes. Turning the Q-TRAK off will *not* erase data. Use the SAMPLE key to start and stop a sample.

LOG Modes:

There are three LOG modes: LOG 1, LOG 2, and LOG 3. When one of these modes is selected using the SAMPLING MODE key, the LOG mode number is listed at the top of the display. The LOG modes allow you to record data points for later retrieval and analysis using the software provided with the instrument.

Use the SAMPLE key to start and stop recording. The word "RECORDING" appears at the top of the display when recording is in progress. Use the CO_2, TEMP HUMIDITY, or CO keys to select which measurement is displayed during recording.

The frequency that data is recorded can be set for LOG 1 mode with the LOGGING INTERVAL key. Use TRAKPRO software for LOG 2 and LOG 3 modes.

Data recorded using one of the LOG modes can only be erased by using the CLEAR MEMORY key. Turning the Q-TRAK off *will not* erase data. Recording another sample with one of the LOG modes, without clearing memory first, causes new data to be added to the existing data (using a new test ID).

CLEAR MEMORY Key

Use the CLEAR MEMORY key to erase all data. The CLEAR MEMORY key will *not* respond unless the Q-TRAK is first put into one of the three LOG modes by using the SAMPLING MODE key.

***Note**: You should first download your data to your computer through the TRAKPRO software. There is only one block of memory in the Q-TRAK. Clearing the memory for one LOG mode clears memory for all LOG modes.*

To clear memory, press and hold the CLEAR MEMORY key until the countdown reaches zero, then release quickly. This prevents accidental erasure of data. Releasing the key too soon or too late prevents memory from being cleared … try again.

LOGGING INTERVAL Key

Use the LOGGING INTERVAL key to view or set the frequency/averaging period for recording data in LOG 1 mode or to view the current interval setting in LOG 2 and LOG 3 mode. Use TRAKPRO software to set the logging interval for LOG 2 and LOG 3 mode. The LOGGING INTERVAL key will not respond unless the Q-TRAK is first put into one of the three logging modes. Press the LOGGING INTERVAL key momentarily to view the current logging interval. Press and hold the LOGGING INTERVAL key to sequence through the available choices and release the key when the desired interval is on the display (LOG 1 mode only).

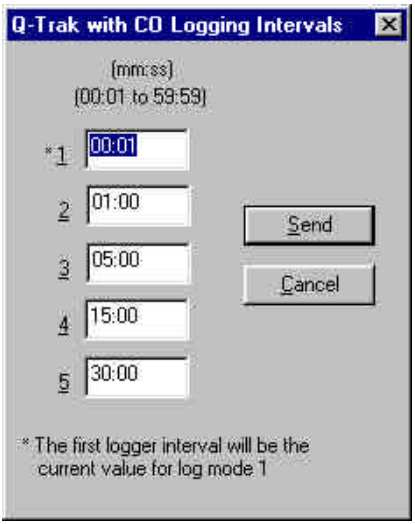
The logging interval is both a frequency and an averaging period. For example, when the logging interval is set to 30 minutes, readings will be recorded at 30-minute intervals. Each reading will be the average value measured over that 30-minute interval.

As shipped from the factory, the available logging intervals for LOG 1 mode are 1 second, 1 minute, 5 minutes, 15 minutes, and 30 minutes. Use the TRAKPRO data analysis software to alter these values.

Programming the Logging Intervals Using TRAKPRO

To program the list of logging intervals available for LOG 1 mode:

1. Make sure the Q-TRAK is connected to the computer and turned on.
2. Select **Parameters**, then **Logging Intervals** from the **Instrument Setup** menu. TRAKPRO retrieves the current logging intervals from the Q-TRAK and displays them in the following dialog:



3. Enter a value for each of the five available logging intervals (the range is from 1 second to 59 minutes and 59 seconds).
4. Select **Send**.

The Q-TRAK is reprogrammed to offer the logging intervals you have specified.

↑ and ↓ Keys

The two arrow keys are used to adjust readings when calibrating the Q-TRAK and for adjusting the time and date for the internal real-time clock.

Display/Keypad Lockout Switch

Recording data over extended time periods often requires leaving the Q-TRAK unattended. To reduce the risk of having an unauthorized person either intentionally or inadvertently interrupt the measurements, you can lock the display and keypad.

This switch is located on the side of the Q-TRAK between the probe mounting brackets. It is a small slide switch and is recessed so that a pointed instrument must be used to move it.

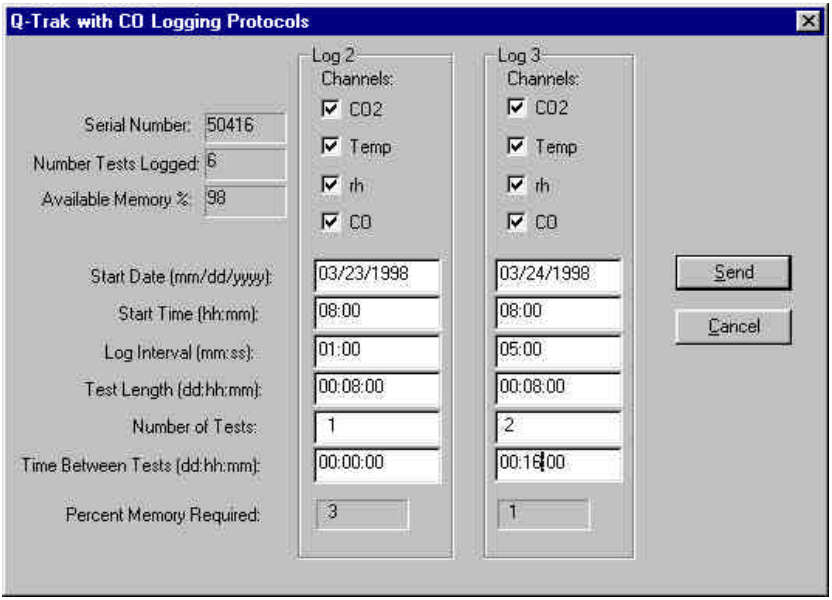
The instrument case is labeled next to the switch with the symbols "I" and "0." With the switch in the "I" or on (up) position, all keypad and display functions will work normally. There are two ways to use the lockout switch. You can lock the keypad (move the switch to the "0" position) after recording starts, or you can put the switch into the lockout position prior to when recording starts. If you select the second method, you will be able to operate all functions normally *until* the SAMPLE key is pressed in one of the LOG modes. At that time the keypad will automatically lock. When the display and keypad are locked, the display shows the words "RECORDING LOG X ↓" where "X" is the current LOG mode number.

Programming Advanced Modes: LOG 2 and LOG 3

Use LOG 2 or LOG 3 modes for unattended recording and setting user protocols. With LOG 2 and LOG 3 modes you can set the start date, start time, test length, logging interval, number of tests, and the time delay between tests. All or selected parameters can be set.

To program a protocol for LOG 2 or LOG 3 mode:

1. Make sure the Q-TRAK is connected to the computer and turned on.
2. Select **Logging Setup** from the **Instrument Setup** menu. TRAKPRO retrieves the current settings for LOG 2 and LOG 3 modes from the Q-TRAK and displays them in the following dialog:



The following table summarizes the information displayed in the Advanced Logging Modes dialog box:

Serial Number	Displays the serial number of the logging instrument.
Number of tests logged	Displays the number of tests currently logged and stored in the logging instrument.
Available Memory (%)	Displays the percent of available memory in the logging instrument.

LOG 2 and LOG 3 Mode Protocols	
Channels	Displays the channels selected for sampling in LOG 2 and LOG 3 modes.
Start Date	Displays the start date for LOG 2 and LOG 3 modes.
Start Time	Displays the start time for LOG 2 and LOG 3 modes.
Log interval	Displays the log interval for LOG 2 and LOG 3 modes.
Test length	Displays the test length for LOG 2 and LOG 3 modes.
Number of tests	Displays the number of tests for LOG 2 and LOG 3 modes.
Time between tests	Displays the time between tests for LOG 2 and LOG 3 modes.
Percent memory required.	Displays the percent of logger memory required to perform a LOG 2 or a LOG 3 mode sample. To store the results of a LOG 2 or LOG 3 mode sample, the **Available Memory** must be equal to or greater than the **Percent memory required**.

3. Enter the following for LOG 2 and LOG 3 modes:

Channels	Select the channels for which you want to log data. In the case of the Q-TRAK, there are four channels to select: CO_2, Temp, rh, and CO.
Start Date **Start Time**	Enter the date and time to begin the sample: • If you enter a blank for a start date, the sample begins whenever the specified start time occurs. • If you enter a blank for the start time, both start date and start time are ignored, and the sample begins when the operator manually starts the sample.
Log interval	Enter the log interval to use for the test.
Test length	Enter the length for the sample: • If you enter a value, the instrument automatically turns off when the last test is complete. • If you enter a blank, the operator must manually stop the sample.
Number of tests	Enter the number of tests to perform.
Time between tests	If you have specified more than one **Number of tests**, enter the time between tests. If you enter 0 or blank, the next test is started immediately after the last test is complete.

While you are entering values for LOG 2 and LOG 3 modes, the **Percent Memory Required** is dynamically updated to show the amount of logger memory required to take the programmed sample. If the protocol you have defined requires more than 100% of memory, you can decrease the amount of memory required by manipulating the following protocol parameters:

- Increase the logging interval.
- Decrease the length for the test.
- Decrease the number of tests.
- Decrease the number of channels.

The settings for each LOG mode must not require more than 100% of the logger memory. Note also that if the **Percent memory required** is greater than the **Available memory**, the logging instrument automatically stops the test when memory is full.

4. When you have finished defining the parameters for LOG 2 and LOG 3 modes, select **Send**.

5. You can now disconnect the Q-TRAK and cable from the computer.

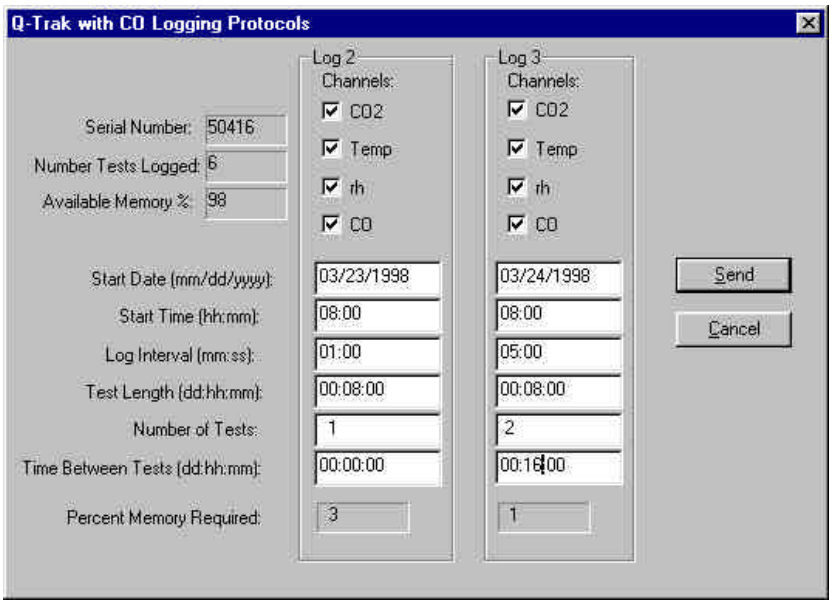
Sample Protocol for LOG 2 and LOG 3 Modes

The following steps describe how to program a sample protocol for LOG 2 or LOG 3 mode.

The sample protocol for LOG 2 is set to take unattended readings for one day, 3/23/98. The logging sample begins at 8:00 a.m. and continues for 8 hours.

The sample protocol for LOG 3 is set up to take unattended readings for two days, beginning on 3/24/98. The logging sample begins at 8:00 a.m. and continues for 8 hours. The instrument is off for 16 hours, and then repeats the 8 hours test on the following day.

The following graphic gives the appearance of the dialog box displayed in TRAKPRO, with these particular logging parameters.



To program this logging example, do the following:

1. Make sure the Q-TRAK is connected to the computer and turned on.

2. Select **Logging Setup** from the **Instrument Setup** menu. TRAKPRO retrieves the current settings for LOG 2 and LOG 3 modes from the Q-TRAK and displays them in the previous dialog.

3. Enter the following for LOG 2 and LOG 3:

Setting	LOG 2	LOG 3
Channels	CO_2, Temp, rh, CO	CO_2, Temp, rh, CO
Start Date	03/23/1998	03/24/1998
Start Time	08:00	08:00
Log interval	01:00	05:00
Test length	00:08:00	00:08:00
Number of tests	1	2
Time between tests	00:00:00	00:16:00

4. Select **Send**. The logging instrument is programmed for the mode 2 and mode 3 protocols.

5. Note that the LOG 2 test requires 3% of the available memory and LOG 3 requires 1% of the memory. A total of 98% of the memory is available for use.

6. You can now disconnect your Q-TRAK from the computer. Refer to other sections of this Operation and Service Manual for details on making measurements using LOG 2 and LOG 3 modes.

After programming the Q-TRAK with the TRAKPRO Data Analysis Software, take the Q-TRAK to the desired location and turn it on. Put it into LOG 2 or LOG 3 mode (whichever you programmed) using the SAMPLING MODE key. Press the SAMPLE key to initiate the program.

If you have set a start time and/or date, the display toggles between the next "TEST ID" and the "ELAPSED TIME 0" message. If the test start time is greater than one minute away, the Q-TRAK shuts off until one minute before the test start time. This indicates that the Q-TRAK is waiting until the programmed start time and dates occur. You may want to lockout the display and keypad at this time to prevent tampering.

Things You Should Know About Taking Pre-Programmed Samples

If you press the SAMPLE key during programmed recording, the program terminates (unless the keypad is locked).

If the programmed start time and date has already passed, pressing the SAMPLE key has no effect. The program never executes.

Setting the start time but no start date causes the Q-TRAK to start at the specified time regardless of the date.

If no start time is set, the Q-TRAK waits for you to press the SAMPLE key and starts sampling immediately.

If no test length is set, the Q-TRAK samples continuously until the SAMPLE key is pressed to stop sampling or until the memory is full.

When a pre-programmed test ends, the Q-TRAK automatically shuts off. When it is turned on again, it will be in Survey mode.

Memory Considerations

The Q-TRAK has a great deal of memory and you will not normally have to be concerned with running out. The Q-TRAK has 128,000 bytes of internal memory. This should be considered when selecting a logging interval. Shorter logging intervals use memory more quickly than longer intervals.

A recorded data set consumes 6 bytes for Model 8550 and 8 bytes for Model 8551 (2 each for CO_2, CO, temperature and humidity.) In addition, each test (labeled with a TEST ID number) needs 100 bytes for storing statistics and setup information. (The formulas below ignore this 100 bytes to keep the calculations simpler.) Based on this information, the Q-TRAK is capable of storing approximately 21,000 data sets for Model 8550 and 15,750 for Model 8551:

***Note**: LOG 2 and LOG 3 modes can be programmed to record any of the measurements separately, i.e., only CO_2, or CO_2 and temperature but not humidity, etc. If only one measurement is recorded, up to 63,000 data points could be stored. The discussion below assumes four measurements are recorded.*

$$\text{Max Data Points} \approx \frac{128{,}000}{8} = 16{,}000$$

Therefore 1% of memory is about 160 data sets. The maximum possible duration of a data logging session is determined by the logging interval and the available memory. The equation below can be used to determine any memory, recording time or logging interval restraints.

$$\%\ \text{Memory} \approx \frac{\left[\ \text{Elapsed Time}\ \right]}{[160] \times [\text{Logging Interval}]}$$

(***Note**: Elapsed Time and Logging Interval are in units of minutes*.)

Chapter 4

Calibration and Maintenance

The Q-TRAK requires very little maintenance to keep it performing well.

The Q-TRAK may be calibrated in the field using the instructions below. Even so, we recommend that you return your Q-TRAK to TSI for calibration annually. For a reasonable fee, we will quickly clean and recalibrate the unit, update software and firmware, and return it to you in "as new" working condition along with a Certificate of Calibration and NIST Traceability. The factory calibration is more precise than can be accomplished with the procedures below. This "annual checkup" helps ensure that the Q-TRAK is always in good operating condition.

Calibrating the CO_2 Concentration Measurement

TSI recommends calibrating the Q-TRAK CO_2 measurement monthly to help ensure accurate readings. The CO_2 concentration measurement is affected by changes in atmospheric pressure. Normal day-to-day variations due to local weather conditions have little effect. However, changes in altitude can cause more significant errors. For best accuracy, calibrate the Q-TRAK CO_2 measurement for your local conditions or if conditions change.

To calibrate the CO_2 sensor, please follow the procedure below. Brief instructions can also be found on the calibration collar itself. You will need a cylinder of pure air or nitrogen for the zero calibration and a cylinder of gas with a known concentration of CO_2 for the span calibration. Contact your local TSI distributor for available CO_2 calibration kits.

***Note**: If using air for calibration, it must be specified to have less than 10 ppm CO_2. Ambient room air cannot be used.*

If necessary, you can select between the factory CO_2 calibration and a user calibration. Please refer to Appendix B: "Internal DIP Switch Settings."

The calibration procedure can be aborted at any time by pressing the CO_2, TEMP, or HUMIDITY key.

If an error occurs during the CO_2 calibration procedure, the Q-TRAK displays the message "ERR." Press the CO_2, TEMP, or HUMIDITY key to abort the calibration. Switching the zero gas with the span gas is an example of a condition that causes the "ERR" message to come on.

1. Locate the calibration collar and slide it over the sensing probe. Make sure that the collar completely covers the CO_2 diffusion holes. Refer to Figure 4–1.

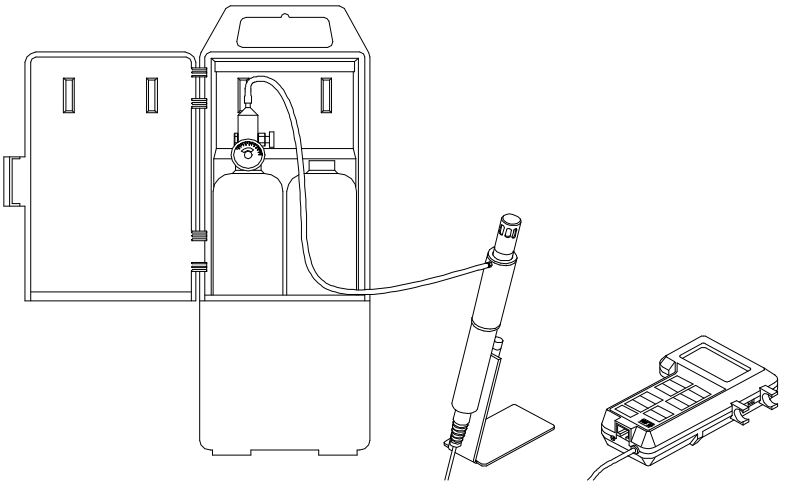


Figure 4–1: CO_2 Calibration

2. Install the regulator onto the zero calibration gas cylinder and connect tubing from the cylinder to the fitting marked "GAS IN" and turn the gas on (0.3 L/min). Make sure the cylinder is not empty. It should quietly "hiss" when it is on.

3. To put the Q-TRAK into CO_2 calibration mode, first put the instrument into Survey mode, and then press and hold the CO_2 key. The display begins to count down from five to zero. When the count reaches zero, release the CO_2 key immediately. The words "CALIBRATE ZERO" should appear on the display. If not, try again.

***Note**: DIP switch 2 must be set to the "User Calibration" (ON) position or the Q-TRAK will not go into CO_2 calibration mode. Please refer to Appendix B: "Internal DIP Switch Settings."*

4. Press the SAMPLE key to take a zero measurement. The Q-TRAK will display a 60-second count-down. When the count-down is completed, the display shows the word "CALIBRATE 1," the next span concentration (typically 1000 ppm), and the arrow symbols (↑↓) will be blinking. Turn off the regulator and disconnect the zero calibration gas.

5. Install the regulator onto the span calibration gas cylinder and attach a tube from cylinder to the fitting marked "GAS IN." Make sure the cylinder is not empty, then turn the gas on (0.3 L/min). A CO_2 concentration of between 1000 and 5000 ppm should be used.

6. Use the arrow (↑↓) keys on the Q-TRAK keypad to adjust the display to match the known span gas concentration. Press quickly and release the arrow key to change the display 1 ppm at a time. Hold the arrow key down to move more quickly. The span gas concentration value (ppm) is marked on the gas container.

7. Press the SAMPLE key to take a span reading. The Q-TRAK will display a 60-second count-down. When the count-down reaches zero the Q-TRAK will go into Survey mode. Turn the instrument **off**.

8. Turn the instrument **on** and observe the reading displayed on the Q-TRAK. It should be very close to the span gas concentration (within specifications: See Appendix A). If not, repeat the calibration.

9. If the displayed reading is accurate, turn the gas off and remove the calibration collar and regulator. The calibration is now completed.

Calibrating the Temperature or Relative Humidity Measurement

To perform a temperature or humidity calibration on the Q-TRAK you will need a reference temperature or humidity device, preferably one that is more accurate than the Q-TRAK. To obtain the best accuracy, care must be taken so that both the Q-TRAK probe and the reference device are able to sense the same air. Also, it's best to calibrate at a temperature and humidity that is near the range you typically measure. In most cases this will be room temperature.

Caution
Never submerge the probe or Q-TRAK in water or any other liquid. The sensor will be damaged.

If necessary, you can select between the factory calibration and a user calibration. Please refer to Appendix B: "Internal DIP Switch Settings."

1. Locate the Q-TRAK probe and the reference device sensor so that they "see" the same air conditions.

2. To put the Q-TRAK into calibration mode, first put the instrument into Survey mode and then press and hold the key, TEMP or HUMIDITY, that you wish to calibrate. The display begins to count down from five to zero. When the count reaches zero, release the key immediately. The word "CALIBRATE" should appear on the display along with blinking arrow symbols (↑↓). If not, try again.

***Note**: DIP switch 3 or 4 must be set to the "User Calibration" (ON) position or the Q-TRAK will not go into calibration mode. Please refer to Appendix B: "Internal DIP Switch Settings."*

3. Compare the reading on the Q-TRAK with the reading from the reference device. If they differ, use the arrow keys (↑↓) on the Q-TRAK to adjust the Q-TRAK display as needed so that the displayed measurement matches the measurement indicated by the reference device. Press the arrow key briefly to change the display 0.1 degree or 0.1% at a time. Hold the arrow key down to change more quickly.

***Note:** If the two readings are the same, there is no need to proceed with the calibration. Press the CO_2, TEMP, or HUMIDITY key to terminate the calibration procedure.*

4. Press the SAMPLE key to take a measurement. The Q-TRAK will display a 15-second count-down. When the count-down is completed, the Q-TRAK will go back to survey mode.

5. Observe the displayed reading on the Q-TRAK, it should agree with the reference device within specifications (see Appendix A). If not, repeat the calibration.

6. If the displayed reading is accurate, the calibration is completed.

Calibrating the CO Concentration Measurement (Model 8551 only)

TSI recommends calibrating the Q-TRAK CO measurement monthly to help ensure accurate readings. The CO concentration measurement is affected by changes in temperature and atmospheric pressure. Normal day-to-day variations due to local weather conditions have little effect. However, changes in altitude can cause more significant errors. For best accuracy, calibrate the Q-TRAK CO measurement for your local conditions or if conditions change.

To calibrate the CO sensor, follow the procedure below. You will need a cylinder of pure air for the zero calibration and a cylinder of gas with a known concentration of CO for the span calibration, 35 ppm or 200 ppm is recommended. Contact your local TSI distributor for available CO calibration kits.

***Note**: Calibration with CO gas should always be done in a well-ventilated area.*

If necessary, you can select between the factory CO calibration and a user calibration. Please refer to Appendix B: "Internal DIP Switch Settings."

The calibration procedure can be aborted at any time by pressing the CO, CO_2, TEMP, or HUMIDITY key.

If an error occurs during the CO calibration procedure, the Q-TRAK will display the message "ERR." Press the CO, CO_2, TEMP, or HUMIDITY key to abort the calibration. Switching the zero gas with the span gas is an example of a condition that will cause the "ERR" message to come on.

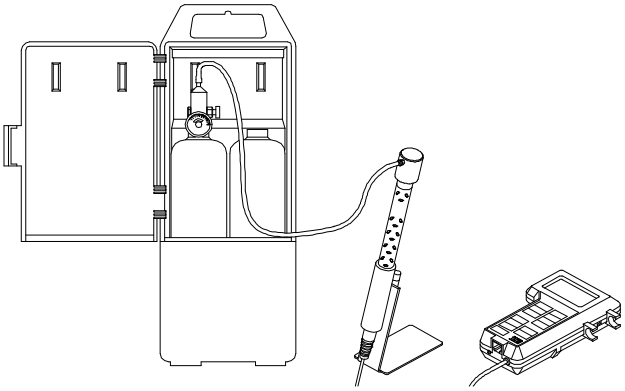


Figure 4–2: CO Calibration

1. Locate the calibration adapter and slide it over the sensing probe. Make sure that the adapter completely covers the CO diffusion holes at the tip of the probe.
2. Install the regulator onto the zero calibration gas (must contain 0_2, e.g., zero air) cylinder and connect tubing from the cylinder to the inlet of the calibration adapter and turn the gas on (0.3 L/min). Make sure the cylinder is not empty.
3. To put the Q-TRAK into CO calibration mode, first put the instrument into Survey mode, and then press and hold the CO key. The display begins to count down from five to zero. When the count reaches zero, release the CO key immediately. The words "CALIBRATE ZERO" should appear on the display. If not, try again.

***Note**: DIP switch 7 must be set to the "User Calibration" (ON) position or the Q-TRAK will not go into CO calibration mode. Please refer to Appendix B: "Internal DIP Switch Settings."*

4. Press the SAMPLE key to take a zero measurement. The Q-TRAK will display a 90-second count-down. When the count-down is completed, the display shows the word "CALIBRATE 1" and the arrow symbols (↑↓) will be blinking. Turn off the regulator and disconnect the zero calibration gas.

5. Install the regulator onto the span calibration gas cylinder and attach a tube from cylinder to the inlet fitting of the calibration adapter. Make sure the cylinder is not empty, then turn the gas on.
6. Use the arrow (↑↓) keys on the Q-TRAK keypad to adjust the display to match the known span gas concentration. Quickly press and release the arrow key to change the display 1 ppm at a time. Hold the arrow key down to move more quickly. The span gas concentration value (ppm) should be marked on the gas container.
7. Press the SAMPLE key to take a span reading. The Q-TRAK will display a 90-second count-down. When the count-down reaches zero the Q-TRAK will go into Survey mode.
8. Observe the reading displayed on the Q-TRAK. It should be very close to the span gas concentration (within specifications: see Appendix A). If not, repeat the calibration.
9. If the displayed reading is accurate, turn the gas off and remove the calibration adapter. The calibration is now completed.

Replacing the CO Sensor

The electro-chemical CO sensor will need to be replaced approximately once a year. Conditions that may indicate a sensor needs to be replaced are: 1) the sensor will not hold calibration, or 2) the response is very unstable. Caution must be taken when operating at very low or high temperatures. Exposing the sensor to sub-freezing temperatures can cause permanent damage to the sensor. Exposing the sensor to high temperature for long periods of time can cause the sensor to dry out which will shorten the sensor life. The sensor has a built in filter to eliminate interfering gasses. This filter will last the life of the sensor under normal background gas levels. To replace the sensor follow the procedure below.

W A R N I N G
The CO sensor contains a corrosive material, avoid contact with eyes and skin.

1. Unscrew cap from end of probe.
2. Carefully bend flex circuit assembly away from old CO sensor.
3. Remove old sensor by gently pulling sensor straight off the end of the probe. Do ***not*** twist the sensor, this will damage the connector.
4. Obtain a new sensor, tear open foil pouch, and remove new sensor. Inspect new sensor for visible signs of damage or leakage. Discard old sensor.

5. Line up notch on sensor with connector and gently push sensor onto the connector.
6. While holding flex circuit against CO sensor, carefully thread thermistor through cap and screw cap on probe.
7. Turn on Q-TRAK. A one-time, 30-minute stabilization period is needed only after sensor replacement. After the stabilization period, calibrate the sensor by following the procedure above.

Storage Precautions

When storing the Q-TRAK for more than 30 days, you should remove the batteries. This prevents damage due to battery leakage.

This instrument must be stored in a location where the temperature remains between -20 and 60°C (-4 and 140°F) and the relative humidity between 15% and 90%.

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Chapter 5

Troubleshooting

The table below list the symptoms, possible causes and recommended solutions for common problems encountered with the Q-TRAK.

Symptom	Possible Cause	Corrective Action
No Display.	Unit not switched on.	Switch unit on.
	Low or dead batteries.	Replace the batteries or plug in the AC adapter.
	Lockout switch enabled	Disable lockout switch
	Dirty battery contacts.	Clean the battery contacts.
Battery symbol is displayed (constant or blinking).	Low battery charge.	Replace batteries or use AC Adapter.
	Incorrect AC Adapter.	Replace with the correct AC Adapter.
	Low AC line Voltage.	Correct the AC line voltage or use batteries.
	Dirty battery contacts.	Clean the battery contacts.
Display reads "MEMORY 0%."	Memory is full.	Download memory to a PC if desired, then clear memory.
Humidity reading near zero or not believable.	Probe exposed to intense light.	Shade the probe while taking samples.
Cannot enter calibration mode.	DIP switch(s) set to factory calibration.	Change DIP switch setting. See Appendix B.
	Not in Survey mode.	Change to Survey mode.
	Sample is in progress.	Stop sample in progress.
Incorrect function displayed.	Two keys have been pressed at the same time.	Press only one key at a time.

Symptom	Possible Cause	Corrective Action
No keypad response.	Display/Lockout switch in lockout position.	Slide lockout switch to normal position.
"ERR" Displayed during calibration procedure.	A mistake has been made such as switching the zero and span gases.	Press CO_2, TEMP or HUMIDITY key to abort calibration. Review instructions and try again.
"SERVICE" and "1" displayed.	Memory has been cleared due to temporary loss of power from internal backup battery.	Factory service required if condition persists. Press any key to bypass.
"SERVICE" and "2" displayed.	Calibration memory error. Internal calibration data corrupted.	Factory service required.
"SERVICE" and "3" displayed.	Temperature sensor malfunction.	Factory service required. Press any key to bypass.
"SERVICE" and "4" displayed.	CO_2 sensor malfunction.	Factory service required. Press any key to bypass.
"SERVICE" and "5" displayed.	Humidity sensor malfunction.	Factory service required. Press any key to bypass.
"SERVICE" and "6" displayed.	Low batteries are the most common cause of this error. If error persists, infrared light source malfunction may have occurred.	Replace batteries or operate with AC adapter. Press any key to clear error. Turn instrument off/on. Factory service required to replace light source. Press any key to bypass error.
"SERVICE" and "7" displayed.	Backup battery low.	Factory service required . Press any key to bypass.
"SERVICE" and "8" displayed.	CO sensor not detected. CO signal out of range. CO sensor malfunction.	Check that CO sensor is properly installed. Recalibrate CO sensor. Replace and recalibrate CO sensor. Factory service possibly required. Press any key to bypass.

Appendix A

Specifications

Specifications are subject to change without notice.
Specifications in parentheses () indicates English equivalents.

CO_2:

Sensor type:	Non-Dispersive Infrared (NDIR)
Range:	0-5000 ppm
Accuracy:	±3% of reading ±50 ppm at 25°C (77°F). [Add uncertainty of ±0.36% per °C (±0.2% of reading per °F) for change in temperature.]
Resolution:	1 ppm
Response time:	20 seconds (for 63% of final value for 500 ppm step change)

Temperature:

Sensor type:	Thermistor
Range:	0 to 50 °C (32 to 122 °F)
Accuracy:	±0.6 °C (1.0 °F)
Resolution:	0.1 °C (0.1 °F)
Response time:	30 seconds (90% of final value, air velocity at 2 m/s)
Display units:	°C or °F (user selectable)

Humidity:

Sensor type:	Thin-film capacitive
Range:	5 to 95 %rh
Accuracy:	±3 %rh (includes ±1% hysteresis.)
Resolution:	0.1 %rh
Response time:	20 seconds (for 63% of final value)

CO (Model 8551 only):

Sensor type:	Electro-chemical
Range:	0–500 ppm
Accuracy:	± 3% of reading or 3 ppm whichever is greater [add ±0.5%/°C (0.28%/°F) away from calibration temperature]
Resolution:	1 ppm
Repeatability:	± 2% of reading
Response time:	< 60 seconds to 90% of final value

Instrument Temperature Range:

Operating range:	5 to 45 °C (41 to 113 °F)
Storage range:	-20 to 60 °C (-4 to 140 °F)

Time Constant:

Range:	Adjustable from 2 to 60 seconds

Data Logging:

Data points:	63,000 (14 days of logging simultaneous CO_2, Temperature, and Humidity at 1-minute intervals).
Logging interval:	User adjustable from 1 second to 1 hour

Power Requirements:

Batteries:	Four AA-size Alkaline or NiCd
or	
AC adapter:	6 VDC nominal, 300 ma, [Q-TRAK mates with 5.5 mm OD x 2.1 mm ID plug, center pin positive(+)]
Approx. battery Life:	13.5 hours (Alkaline), 4.75 hours (NiCd)

Physical:

External dimensions:	107 mm x 183 mm x 38 mm (4.2 in x 7.2 in x 1.5 in)
Probe length:	Model 8551: 17.8 cm (7.0 in) Model 8550: 14.7 cm (5.8 in)
Probe diameter:	1.9 cm (0.75 in)
Weight:	0.59 kg (1.3 pounds) (with batteries)
Display:	4-digit LCD, 15 mm (0.6 in) digit height

Maintenance Schedule:

Factory calibration:	Annually
User calibration:	As needed

Serial Interface:

Type:	RS-232
BAUD rate:	1200
Data bits:	8
Stop bits:	1
Handshaking:	None
Data format:	ASCII

Calibration Gas

CO_2 zero:	Nitrogen or pure air (<10 ppm CO_2)
CO_2 span:	1000–5000 ppm CO_2
CO zero:	Pure air (<0.5 ppm CO)
CO span:	35–500 ppm CO
Gas flow rate:	0.3 to 0.5 L/min

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Appendix B

Internal DIP Switch Settings

To access the DIP switches, remove the batteries from the battery compartment. On the inside of the battery compartment, there is a window with eight DIP switches The table below shows the functions for each switch. Please refer to Figure B–1 for switch locations.

Caution
Make certain that power is turned off before changing DIP switch settings.

Switch	OFF	ON
1	Degrees Celsius (°C)	**Degrees Fahrenheit (°F)**
2	Factory CO_2 Cal.	**User CO_2 Cal.***
3	Factory Temp. Cal.	**User Temp. Cal.***
4	Factory Humidity Cal.	**User Humidity Cal.***
5	Beep Disabled	**Beep Enabled**
6	Reserved	**Reserved**
7	Factory CO Cal.	**User CO Cal.***
8	Reserved	**Reserved**

* As shipped the user calibration is identical to the factory calibration
- Factory default settings are indicated with **BOLD** type.
- The ON position is away from the batteries and OFF is towards the batteries.
- Switch 1 is towards the display and switch 8 is nearest to the data port.

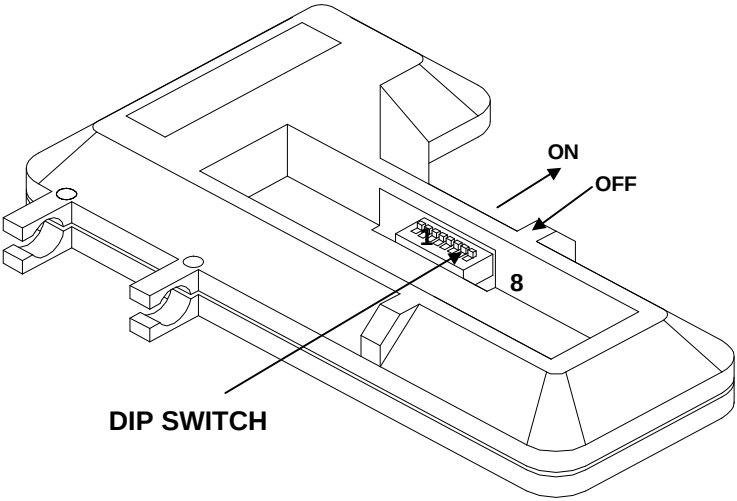
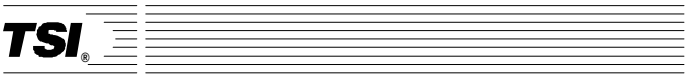


Figure B–1: DIP Switch Location



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